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Untapped Potential:

IRB Guidance for the Ethical Research Use of Stored Biological Materials

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Research involving stored biological materials has been useful for identifying genes and gene changes associated with disease or disease susceptibility,[1] determining causes of mortality and morbidity,[2] deriving cell lines for further research,[3] and developing new therapeutic approaches.[4] However, such research also raises special ethical concerns. In the United States, the National Marrow Donor Program had to recontact thousands of donors because many samples had been collected for research without consent.[5] In Canada, Native Americans demanded return of their stored biological materials after learning that researchers who had collected the materials to study rheumatoid arthritis had also used them in other research.[6] As existing biological materials banks expand and new research collections are created,[7] it is essential that investigators and institutional review boards (IRBs) be attentive to the ethical issues raised by research with human biological materials.

Federal regulations governing research with humans permit research use of existing, unidentified biological materials without consent.[8] Yet, the regulations provide little additional guidance on these issues, and guidelines from scientific and professional groups are inconsistent.[9] In the absence of clear federal policy, IRBs must develop their own guidelines to evaluate research with stored biological materials. However, little is known about whether IRBs are providing needed guidance to investigators who must obtain IRB approval for their research protocols. We conducted this study to determine whether IRBs provide guidance regarding the ethical issues on research with stored biological materials and to identify ways to improve IRB guidance regarding such research.

Ethical Issues in Research with Stored Biological Materials

The ethics literature has identified particular concerns regarding research with stored biological materials. We conducted an initial search of the literature using the PubMed search engine, using the following keywords: "stored tissue," "biological materials," "tissue," "specimen," "sample," "DNA," and "genetic" combined with "ethics." We scanned the references of relevant publications for additional works not captured by our PubMed searches. Four major research topics were identified: consent, control over future use of biological materials, confidentiality of biological materials and research results, and disclosure of research results to donors of biological materials. We added the use of children's biological materials during our review of IRB guidance documents. We developed specific research questions for each of these

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Table 1
Research Questions

Topic	Questions
Consent	Does the IRB discuss consent for use of previously collected biological materials for unanticipated uses?
	Does the IRB recommend offering participants different options for future uses of prospectively collected biological materials (tiered consent)?
	Does the IRB discuss withdrawal of biological materials after collection?
Use of biological materials	Does the IRB discuss the potential development of commercial products using the biological materials?
	Does the IRB discuss sharing the biological materials with other investigators?
Confidentiality	Does the IRB discuss the need to protect confidentiality of biological materials sources and steps to do so?
Disclosure of research results	Does the IRB discuss whether and under what circumstances research results should be disclosed to biological materials donors?
Pediatric research	Does the IRB discuss the special considerations presented by biological materials obtained from children?

major topics based on the literature review. The questions are listed in Table 1.

■ *Consent.* Leftover biological materials from clinical care historically have been used for research based on general consent.[10] However, using biological materials without informing donors may undermine public trust.[11] Donors may be wronged if their materials are used without their consent, even if they are not harmed. There is disagreement over whether additional consent is necessary for new research uses of existing materials.[12] There is also disagreement over how investigators should obtain consent for biological materials collected prospectively. For example, one professional group suggests that consent is not required for materials collected anonymously or that will be anonymised.[13] On the other hand, several groups have suggested that research participants should consent to any prospective collection and be given options over scope of use.[14] Others contend that it is inappropriate to ask donors to consent to unspecified future uses because the risks cannot be known.[15]

■ *Control Over Future Use of Materials.* There is debate over how much control donors should have over the future use of their materials. For example, some donors may object to commercial use of their biological materials.[16] Similarly, some donors may object to having their biological materials shared with other investigators. Some groups suggest that donors should be permitted to limit such uses,[17] while others oppose such limits.[18]

■ *Confidentiality of Biological Materials and Research Results.* Breach of confidentiality and invasion of privacy are the main risks of research with stored biological materials.[19] The public is concerned about confidentiality of genetic information.[20] However, few articles discuss specific methods for protecting confidentiality in research with stored biological materials.

■ *Disclosure of Research Results.* There is little consensus about when investigators should disclose research results to biological materials donors and what they should disclose.[21] It may be distressing for donors to learn research results if they did not know that investigators had used their materials for research purposes.[22] Moreover, genetic research results may be ambiguous or inconclusive and, therefore, may have limited value to donors and cause unnecessary anxiety if disclosed.[23]

■ *Pediatric Research.* Pediatric research with stored biological materials presents unique issues because children cannot consent to their own research participation. When children reach maturity, they may not agree with their parents' research decisions.[24] There is no consensus about the scope of parental authority with respect to the research use of children's biological materials.[25]

Study Methods

■ *IRB Web Sites.* We studied the stored biological materials policies published on the web sites of the IRBs at the 25 U.S. medical schools that receive the most research funding from the National Institutes of Health (NIH) (Table 2). These schools receive over one-half of NIH funding; thus, their IRBs probably handle the largest number of protocols annually.[26] We identified the institutional IRB web sites by following links on the medical schools' "Research" page or by using the search engine on the institution's main web site. One of the IRBs did not post its polices on a publicly available web site, leaving us with 24 IRBs.

■ *Accessing IRB Guidance Documents.* From September 2001 to February 2002, we searched the web sites of the 24 IRBs for all policies that refer to research with stored biological materials. We downloaded all IRB guidance documents and policies relating to use of biological materials in research, including formal guidelines, manuals, sample consent forms, fact sheets, frequently asked questions, and other discussions contained on the web site. We identified these guidance documents and policies by using indices, links, and search engines on the IRB web site, using the following key words: "stored tissue," "biological materials," "tissue," "specimen," "sample," "DNA," and "genetic." We updated this information in November 2002.

■ *Analysis of IRB Guidance Documents.* In the first phase of our analysis, two reviewers independently analyzed and coded the IRB guidance on the predetermined topics that we identified through our literature review. The reviewers used abstraction forms specifically developed for this study. The reviewers then compared their coding for consistency. Disputes were resolved by discussion and consensus. In the second phase of our analysis, we conducted a close reading of the language of specific IRB guidance documents for a given topic and compared guidance documents from different IRBs. Through this comparison, we identified IRB guidance documents that followed or went beyond current practice for ethics and quality (exemplary practices), as well as IRB guidance documents that appeared to conflict with federal regulations and established ethical standards (problematic practices). Final decisions regarding exemplary and problematic practices were reached by consensus among the research team.

Table 2
Top 25 NIH-Funded Medical Schools

Albert Einstein College of Medicine of Yeshiva University
Baylor College of Medicine
Case Western Reserve University School of Medicine
Columbia University College of Physicians and Surgeons
Duke University School of Medicine
Emory University School of Medicine
Harvard Medical School
Johns Hopkins University School of Medicine
Mount Sinai School of Medicine
Stanford University School of Medicine
University of Alabama School of Medicine
University of California Los Angeles (David Geffen) School of Medicine
University of California San Diego School of Medicine
University of California San Francisco School of Medicine
University of Chicago Pritzker School of Medicine
University of Colorado Health Sciences Center
University of Michigan Medical School
University of North Carolina at Chapel Hill School of Medicine
University of Pennsylvania School of Medicine
University of Pittsburgh School of Medicine
University of Texas Southwestern Medical Center at Dallas
University of Washington School of Medicine
Vanderbilt University School of Medicine
Washington University in St. Louis School of Medicine
Yale University School of Medicine

Study Results

■ *Consent to Use Stored Biological Materials.*

• Existing biological materials

All of the IRBs note that some research with existing biological materials is exempt from federal human research regulations; however, few discuss specific issues that commonly arise in such research.

No previous consent. Twenty-nine percent (7/24) of IRBs address whether existing biological materials may be used in research without prior consent. For example, 3 IRBs state that, when donors did not give explicit consent for future use of biological materials, investigators may use those materials for research purposes only if they are permanently stripped of any identifiers.

Reconsent. Twenty-one percent (5/24) of IRBs address when reconsent is needed to use existing biological materials in research. For example, one IRB requires reconsent or de-identification of samples if the proposed research exposes the participants to greater risk than previously contemplated.

Reliance on clinical consents. Seventeen percent (4/24) of IRBs discuss whether consents for clinical or surgical procedures are sufficient to permit research use of biological materials. One IRB indicates that such consents "may not be presumed to cover research use of specimens." In contrast, 3 IRBs indicate that clinical or surgical consents that explicitly mention research use may substitute for specific research consent.

• Prospectively gathered biological materials

All the IRBs discuss this issue, with substantial variation in the

Table 3
Suggested Options for Informed Consent (from 14/24 IRBs)

Using the specimen in the current study

Contacting the donor for future research participation

Storing specimens for future use

- Allowing identified versus unidentified use of specimens
- Limiting future uses to certain types of research (e.g., related to current study vs. unrelated research)
- Permitting genetic analysis of specimens

Sharing specimens with other researchers

Allowing commercial use of specimens

extent and substance of the discussion.

Consent options. Fifty-eight percent (14/24) of IRBs recommend giving prospective research participants options when asking for permission to use their biological materials in future research. IRBs suggest various consent options, all of which are different (Table 3). Most IRBs suggest sample language. In contrast, 21% (5/24) of IRBs recommend only the option of consenting to all future research.

Opt-out. Twenty-five percent (6/24) of IRBs require investigators to allow research subjects to opt out of donating biological materials for future research while still participating in the current study.

Information regarding IRB review. Only two IRBs recommend consent language that explains that an IRB must approve future protocols (See Table 4, Item F).

Right to withdraw. Seventy-nine percent of IRBs (19/24) discuss the right of donors to withdraw biological materials from future research. Nine IRBs make clear that research participants have a right to withdraw identifiable biological materials. A few of the IRBs address whether this right requires investigators to destroy samples or data or discuss practical limits on this right (See Table 4, Item E). In contrast, three IRBs permit investigators not to allow withdrawal of samples, subject to IRB approval. In cases where subjects withdraw from the research, two other IRBs allow investigators to remove identifiers, rather than destroy the biological materials, provided they inform participants of this policy in the consent form.

■ *Use of Biological Materials.*

• Development of commercial products

Over half (13/24) of IRBs suggest that possible development of commercial products from stored biological materials should be mentioned in the consent form. Two IRBs ask investigators to indicate in the consent form whether donors will share profits from any resulting commercially valuable products. The remaining IRBs assume that biological materials donors will not share in any profits resulting from commercially valuable products developed using their biological materials. A few suggest sample language that explains why this is the case. Only 2 IRBs suggest that investigators seek explicit and separate consent regarding commercial use of biological materials.

• Sharing donated biological materials

Seventy-five percent of IRBs (18/24) discuss the sharing of stored biological materials with other investigators. However, IRBs take different approaches to sharing. Twenty-one percent of IRBs (5/24) require or suggest that investigators seek specific consent from research participants to share their biological materials with other investigators, typically without identifying information. In contrast, twenty-one percent of IRBs (5/24) recommend consent language that asserts the investigators' right to share biological materials. The remaining 8 IRBs raise the issue without suggesting a particular approach.

■ *Confidentiality.*

Seventy-nine percent of IRBs (19/24) address confidentiality of stored biological materials. Twenty-nine percent of IRBs (7/24) suggest specific steps to preserve confidentiality, such as coding samples, keeping identifiers in password-protected databases, limiting access to identifiers and other data, and obtaining a federal Certificate of Confidentiality (See Table 4, Item D). Twenty-one percent of IRBs (5/24) suggest that participants be given the choice of having their sample stored without any identifiers or codes. If investigators retain identifiers, 1 IRB requires investigators to justify why samples cannot be completely anonymized. One IRB explicitly recognizes that DNA's specificity poses limits to confidentiality and suggests sample consent language to address this issue.

■ *Disclosing Research Results to Participants.*

Seventy-five percent of IRBs (18/24) discuss disclosing research results to participants.

Five IRBs not only discuss the options (disclosure and non-disclosure) regarding research results, but also provide a rationale for why an investigator should choose one option over the other (See Table 4, Item B). Five IRBs suggest that participants specifically indicate their preferences regarding receiving research results.

Four IRBs ask investigators to discuss whether there are circumstances in which they would disclose

Table 4
Exemplary Practices from IRB Policies

Provides checklists, algorithm for investigators

A. One IRB has a four page form that guides investigators through a series of questions (and explanations) to help determine whether, for example, consent is required or may be waived

Explains rationale for policies, options

B. Regarding disclosure of research results, one IRB explains that in many cases "it would be unethical to provide results to patients, such as when the research is in the early stages and the clinical significance has not been established. On the other hand, if there is a good chance that the research will yield results that could affect the subjects' medical care, it may be appropriate to tell subjects that" they may choose to receive results.

C. Regarding stored tissue research involving children, one IRB explains that: "In most cases, children should not be included in . . . research where predictive genetic information may be obtained that they might have decided they didn't want discovered if making the decision as an adult. The potential harm to the emotional health and well-being of a child and the parents' interactions with that child if identified to have the disease later in life could be significant."

Gives examples of steps investigators might take to minimize risks

D. Regarding confidentiality, one IRB suggests using a password protected computer database to link identifiers, limiting access to password or coded identifiers, or stripping codes to anonymize specimens.

Suggests language for consent forms regarding issues that may not be obvious to investigators or participants

E. Regarding the right to withdraw from research, one IRB also addresses limits on that right:
"you may ask [investigator] . . . to destroy any sample with your name on it. . . . However, the resulting data from the research will not be discarded. Copies of DNA and/or growing cells made from your samples will not be destroyed. Samples sent to other scientists cannot be identified and destroyed because your name was removed before the samples were shipped to other medical centers."

F. Regarding use of specimens in future research, one IRB suggests how to explain the need for IRB review before specimens are used: "Before any research involving the specimens is conducted, [the IRB] will review and approve the research proposal. The Committee includes scientists and non-scientists, including community representatives. The purpose of [the IRB] is to assure that the interests of individuals participating in research studies are well protected."

Anticipates issues that might arise in the future

G. One IRB requests that investigators: "consider the possibility that. . . over a period of time . . . results may [develop] clinical significance for the subjects or their families. . . If that is a possibility, how will you communicate information to the subject, the subject's families, or the subject's health care provider, and provide genetic counseling?"

research results in the future if they do not currently plan to disclose them (See Table 4, Item G). In contrast, one IRB allows the investigator to disclose research results to those who have specifically refused them "if lacking the information could cause harm to the subject (for example, the subject could develop a treatable disease)." Another IRB's sample language allows investigators to withhold results, even if disclosure might benefit the participant.

■ *Pediatric Research.*
Only 4 IRBs (17%) specifically address research involving stored biological materials of children (See Table 4, Item C). One IRB discusses the right of a child participant to "rescind the permission to use the identifiable biological specimens" as an adult. Another IRB indicates that parents have the right to look at the child's data. In contrast, another IRB states, "no genetic information will be disclosed [to parents] unless there is an intervention that may prevent, ameliorate, or treat the disease the effectiveness of which is improved if the intervention is initiated before the child reaches the age of 18." This IRB also requires the parents' consent and child's assent for such disclosure. The final IRB generally recommends against involving children in predictive genetic research.

Discussion

The sequencing of the Human Genome and improved DNA-based testing expand the research potential of stored biological materials.[27] However, public concerns about such research require special attention to the controversial ethical issues raised by it.[28] In the absence of clear federal guidelines, IRBs need to educate investigators about these ethical issues. We found that IRBs are addressing some of these issues, but that they could be doing more.

■ *Inadequate Coverage of Issues.* Most of the IRBs we examined missed opportunities to educate

Table 5
Topics Identified in Ethics Literature as Important That Most IRBs Do Not Discuss

Topic	*IRBs that do not discuss (N = 24)*
Whether clinical consents may be used as consent for research use of specimens.	83%
Special considerations of research involving stored tissue of children.	83%
Whether and when it may be necessary to obtain additional consent from specimen donors.	79%
Specific steps for preserving confidentiality in stored tissue research.	71%
When consent may be needed for research with existing specimens when consent was not previously obtained.	71%

investigators about ethical issues in research with stored biological materials. First, IRBs fail to mention important topics identified in the ethics literature as needing additional guidance. For example, although every IRB refers to the federal regulations exempting some research using existing materials, over 70% fail to discuss when consent might be necessary for research that presents new risks. Similarly, although most IRBs mention confidentiality in research with stored biological materials, fewer than 30% suggest specific steps for protecting confidentiality. Moreover, one-fifth or more of IRBs fail to discuss confidentiality, sharing of materials, or disclosure of research results at all. If IRBs do not discuss these complex topics, it is unlikely that investigators will address them adequately in their research protocols. Second, IRBs do not use best practices consistently. For example, IRBs that use checklists do not use them for all topics that could benefit from them. Moreover, some IRBs draw investigators' attention to controversial topics by asking questions, without providing guidance on how to answer these questions.

Finally, our study identified some topics that deserve additional discussion in light of wide disagreements. For example, some commentators contend that a "tiered consent" approach is ethically desirable because it offers donors greater control over the research use of their biological materials.[29] However, about one-fifth of IRBs do not inform investigators about the use of tiered consent. Another fifth of IRBs recommend only the option of consenting to all future research. Only 4 IRBs discuss pediatric research involving stored biological materials, and the issues they highlight on this matter vary considerably. Table 5 summarizes the topics that the majority of IRBs fail to address.

■ *Problematic Policies.* A few IRBs have adopted policies that appear to conflict with federal guidances and regulations. Two IRBs' policies exempt unidentifiable, prospectively collected materials from IRB review, though federal regulations apply only to unidentifiable, "existing" materials.[30] Materials must be "on the shelf" before research commences to qualify for exemption.[31] Although some research involving prospective collection of materials may qualify for expedited review and waiver of consent, IRB review is still required.[32]

Three IRBs allow investigators to prohibit subjects from having their samples withdrawn from a study, and 2 IRBs allow investigators to anonymize, rather than withdraw samples, if the participant withdraws from the study. Such policies appear to violate federal human research regulations, which specify that "a subject may discontinue participation at any time."[33] In research with stored biological materials, the right to discontinue participation means withdrawal of samples.

Finally, 1 IRB allows investigators to disclose research results to subjects who have specifically indicated they do not want the results. This practice infringes upon participants' autonomy to determine what and how much information they want about their medical status and genetic profile.[34]

■ *Exemplary Practices.* We identified IRB practices that may be particularly useful in helping investigators think through the ethical issues that arise in research with stored biological materials (Table 4).

• *Providing the rationale for policies or options and including specific examples of suggested, permissible or impermissible practices.* Several IRBs explain when and why certain options are appropriate (Table 4, Items B & C). Such explanations enable investigators to make reasoned choices. In addition, investigators who understand the reasons for IRB decisions may be more likely to accept them.

• *Using checklists or algorithms to walk investigators through the pertinent issues. By standardizing procedures with checklists or "points to consider," institutions can improve the quality of research practices.*[35] The best IRB checklists for research with stored biological materials provide instruction and concrete examples to help the investigator answer the questions (Table 4, Item A).

• *Highlighting and anticipating particular issues that investigators might not otherwise appreciate.* A

few IRBs raise infrequently discussed but important topics, such as explaining in consent forms that any future use of materials requires IRB approval.

Our study has several limitations regarding generalizability. We only evaluated materials on IRB web sites. In addition to (or in lieu of) posting policies and guidance documents on information on their web site, IRBs may be educating investigators individually about policies and may be providing required training programs on research ethics. However, institutional web sites may be more accessible to investigators needing information and guidance than other forms of communication. Another study limitation is that the information on the web sites may have changed since we last visited the sites. Finally, the IRBs at the 25 medical schools that receive the most NIH funding may not be representative of all IRBs. However, these institutions probably carry out the most human subjects research and are likely to have the most resources for their IRB program.

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ANNOTATIONS

Fergusson D, Glass KC, Waring D, Shapiro S. Turning a blind eye: The success of blinding reported in a random sample of randomized, placebo controlled trials. *BMJ Online First*. January 22, 2004. • The authors examine the reporting and success of double blinding in a sample of randomized, placebo-controlled trials from leading general medicine and psychiatric journals. They took a random sample of two hundred trials from pre-specified journals and evaluated 191. Of these 191, 97 were taken from general medicine journals and 94 from psychiatry journals. Seven of the general medicine trials reported evidence on the success of blinding, with five of those studies concluding that the success of blinding was imperfect. Of the psychiatric journals, evidence for the success of blinding was reported in eight of the evaluated trials, with four reporting that blinding was imperfect. The authors contend that as the quality of reporting in clinical trials evolves, there is a need for researchers and journalists to routinely report the methods of blinding and provide evidence for the success and or failure of the blinding. Reporting of trials should include: 1) the counts of all patients allocated to each treatment; 2) the counts of patients who guess treatment assignment by the group to which they were allocated; 3) the counts of correct guesses and those who are undecided; 4) the analytical methods and results used to assess success of blinding; and 5) the author's interpretation of the efficacy of blinding and the effect on the study's results. Only after this evidence is reported will it be possible to correctly assert that assay sensitivity exists in randomized, double blind, placebo-controlled trials.

Levine C, Faden R, Grady C, Hammerschmidt D, Eckenwiler L, Sugarman J. "Special Scrutiny": A targeted form of research protocol review. *Annals of Internal Medicine* 2004;140:220-223. • The authors argue that the traditional methods of protecting participants in research--informed consent, voluntariness, and special regulations for vulnerable groups--while necessary, are not sufficient. Given the changing landscape of research (increasing globalization and privatization, the complexities of multi-site and office based trials, and the rapid development of novel agents) the authors propose a focused "special kind of scrutiny" for research that raises serious moral challenges. They point out that this is not an idea without precedent (the RAC was formed in 1984) and go on to give three examples when special scrutiny might be required: 1) when the research involves initial experiences of translating new scientific advances to studies in humans, especially when the intervention is novel or irreversible; 2) when the research is without potential for offsetting direct medical benefit and there is a risk for significant harm to the participant; and 3) when the research poses ethical questions for which there is no authoritative consensus. Suggestions for a process of special scrutiny include independent review of research risks and routine consultation with relevant experts and community groups.

Hearnshaw H. Comparison of requirements of research ethics committees in 11 European countries for a non-invasive interventional study. *BMJ* 2004;328:141-2. • In a survey of research ethics committees in 11 countries, the author found differences in requirements for committee approval of the same research protocol for a non-invasive interventional study. Hearnshaw concludes that if ethical review is based on the principles of the Declaration of Helsinki, then such variation is the result of either research ethics committees being too lax or too strict. The author notes that the risk of inappropriate requirements delays

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research participants are minimized.

Disclaimer

Views expressed are those of the authors and do not necessarily reflect those of the U.S. Department of Health and Human Services, the National Institutes of Health, or the National Institute of Mental Health.

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14. See ref. 1, Collogan et al. 2004.

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studies unnecessarily, leads to extra costs without further protecting participants, and may lead to the exclusion of certain countries in cooperative international research. Hearnshaw notes that some research, such as some survey research, need not meet all the principles of the Declaration and that research ethics committees should take this into consideration and stop unnecessarily applying the Declaration in a way that is both costly and risky to the research enterprise.

Miller FG, Emanuel EJ, Rosenstein DL, Straus SE. Ethical issues concerning research in complementary and alternative medicine. *JAMA* 2004;291(5):599-604. • Given the increasing interest in and use of complementary and alternative medicines (CAM), the authors examine the ethical issues that surround research on CAM therapies. After giving a short explanation of an ethical framework to evaluate clinical research, the authors apply the framework to three ethical issues concerning research evaluating CAM treatments: 1) the value of rigorous research on CAM; 2) the validity of randomized, placebo-controlled clinical trials of CAM interventions; and 3) the justifications for placebo-controlled trials of CAM therapies for medical conditions despite proven effective conventional treatments. Given the widespread use and lack of standardization of many CAM therapies, they contend it is necessary to perform rigorous, ethically sound research, including placebo-controlled, randomized trials. In determining whether or not it is ethically acceptable to offer CAM treatments if they prove to be no more effective than placebos, the authors conclude that this can be done if CAM offers a favorable risk-benefit ratio when there are no better standard therapeutic options or when the patient refuses standard conventional treatment of proven efficacy.

Edwards SJL, Kirchin S, Huxtable R. Research ethics committees and paternalism. *Journal of Medical Ethics* 2004;30:88-91. • The authors argue that research ethics committees (RECs) should only concern themselves with ensuring that consent is genuine, rather than also stipulating what level of risk a competent person ought be able to assume. They believe that the potential subject should be the one to balance the risks and benefits of research. Edwards et al. justify this conclusion on four grounds: 1) competent people are "epistemologically and ethically" in the best place to decide which risks are reasonable for them, hence, REC constraints on risk taking should be no more restrictive than normal legal constraints; 2) researchers and psychiatrists have the power to determine competence, which is a right that does not belong to RECs; 3) when individual liberty is limited, it is done so in the interest of the greater public good and RECs are not empowered to determine the public interest; and 4) while RECs may have a valid paternalistic role in determining whether or not competent people are being exploited by the use of incentives in research, the moral and political authority of RECs has not been adequately established in this regard.